Base Year: 1999 By: S. Schultz

SOURCE INVENTORY

CATEGORIES # 749 & 1435

FARMING OPERATIONS

1999 EMISSIONS

Introduction

Farming Operations consist of two categories, Agricultural Land Preparation (Category 749) and Agricultural Harvest Operations (Category 1435). Category 749 accounts for particulate emissions generated by farming operations such as tilling, plowing, discing, etc. These activities are normally performed in the early spring and/or fall months. Therefore, particulate emissions from agricultural tilling are highly dependent on type of crop, climate, soil properties and equipment characteristics.

Category 1435 accounts for particulate emissions caused from harvest activities. These activities include harvest vehicles traveling over the soil, mechanical processing of crop and underlying soil, or removal of crop waste material through blowing or sweeping action. As of this writing, the only crops in California that had harvest particulate emissions factors were almonds, walnuts, and cotton. In the BAAQMD, only almonds and walnuts were considered in Category 1435.

Emissions from farming equipment, such as mowers, tractors, tillers, etc., are accounted for in Category 324 (Farm Equipment, Gasoline) and Category 325 (Farm Equipment, Diesel).

Methodology

Category 749

Agricultural land preparation particulate emissions for each crop are estimated using the following equation:

$$\text{Emissions}_{crop} = \text{Emission Factor} * \text{Acres}_{crop} * \text{Acre-Passes/acre}_{crop}$$

The data on the number of acres tilled for various crops in each county for a particular year was obtained from the county's annual crop reports. The emission factor equation (in lb./acre-pass) was obtained from AP-42, Section 11.2.2 as follows:

> Emission Factor $= 4.8 * k * (s)^{0.6}$, where k is the particle size multiplier and s represents the percent silt content in the soil.

The EPA estimated that 33% of the total particulates entrained to the air during agricultural land preparations is 30 microns or less. The Midwest Research Institute (MRI) estimated "s" at 18 percent Therefore, "k" (for total particulates) and "s" are 0.33 and 18, respectively. The PM10 fraction of total particulates was estimated by CARB to be 0.45.

The total particulate emissions are determined by multiplying the emission factor and process rate. Multiplying the number of acres tilled by the number of acre-pass for each crop, and then summing for all of the crops, yields the process rate. Acre-passes are the number of land preparation passes typically performed to prepare a crop for planting. This land preparation activity, which involves discing, tilling, land leveling, etc., may occur prior to planting a new crop or after a harvest. Thus each crop is different in the type of land preparation activities and when they occur. A listing of the crop acre-pases used in California was found in Table 2 of CARB's Source Category on Agricultural Land Preparation, Section 7-4, (CES No. 47332).

Example 1
1999 particulate emissions from land preparation activities for garlic in Santa Clara County=
8.97 lbs. PM/acre-pass * 350 acres * 4.0 acre-pass/acre = 12,558 lbs. PM/yr. or 6.28 tons PM/yr

PM10 emissions = 0.45 * 6.28 tons PM/yr. = 2.83 tons PM10/yr.

where,

a.The emission factor is $4.8 * .33 * (18)^{0.6} = 8.97$ lbs. PM/acre-pass.

b.There were 350 acres devoted to garlic.

c.The acre-pass/acre value (as provided by CARB) was 4.0.

d.45% of total particulate emissions were PM10 emissions.

Category 1435

Agricultural Harvest Operations particulate emissions for each crop are estimated using the following equation:

$$\text{Emissions}_{\text{crop}} = \text{Emission Factor X Acres Harvested}_{\text{crop}}$$

The only crop emission factors relevant and available for the BAAQMD were for almonds and walnuts. For almonds, the total particulate emission factor of 76.0 lbs./acre harvested was based on the sum of shaking, sweeping and almond pickup tests. Since walnut harvesting methods were similar to that for almonds, the same emission factor

was used. The PM10 fraction of total particulates was estimated by CARB to be 0.45. The number of acres devoted to almonds and walnuts was obtained from either the county's annual agricultural crop reports or the California Agricultural Statistics Service (CASS).

Example 2
The 1999 particulate emissions from harvest operations = 76 lbs. PM/acre * 1,174 acres = 89,244 lbs. PM/yr or 44.61 tons PM/yr.

PM10 emissions = 0.45 * 44.61 tons PM/yr = 20.07 tons PM10/yr.

where,

a.The number of acres of almonds and walnuts harvested in Contra Costa County in 1999 was 1,174 acres.

b. 45% of total particulate emissions were PM10 emissions.

Monthly Variation

The monthly variations of emissions for the Bay Area counties in Category 749 were based on CARB's Seasonal Profile for Soil Preparation Emissions (CES Methodology 7.4, Table 3). For Category 1435, the monthly variations of emissions were based on CARB's Percent of Acres Harvested during the year (CES Methodology 7-5). The harvest schedule for almonds and walnuts in all Bay Area counties was divided equally between the months of September and October.

County Distribution

For both categories, the county distribution was based on the crop activity reported by the counties' annual agricultural crop reports or the CASS.

TRENDS

History

From 1979 until the present, both categories' emissions were determined from the annual agricultural report published by each of the nine counties in the Bay Area. Prior to 1979, the backcast emissions for both categories were based on ABAG's Agricultural and Mining Growth Profile

Growth

Projected emissions to 2030 for both categories were also based on ABAG's Agricultural and Mining Growth Profile